ELEMENTARY COMPUTER LITERACY

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1983

Alberta EDUCATION

ACKNOWLEDGEMENTS

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THE COMPUTER LITERACY PROGRAM

INTRODUCTION

The computer literacy program was developed in response to needs expressed by educators in the field and the resolutions passed by the Curriculum Policies Board at its meeting in November, 1980. In March, 1981 a committee was convened to compile a number of recommendations pertaining to the introduction of computer literacy in the Alberta curriculum. These recommendations reflected the view of school system representatives, the chairpersons of various subject area curriculum coordinating committees, and representatives of Alberta Education and ACCESS.

During the following year, three Ad Hoc committees were assembled to develop a unit or course for each of the three levels of schooling: elementary, junior and senior high. Two teaching units were developed to achieve the objectives of the computer literacy program as specified for grades four, five and six, and these units were field tested in 42 official and over 300 unofficial pilot schools throughout the province. The elementary pilot began in September, 1982, with an inservice for the official pilot teachers, and was completed in March, 1983.

Both the junior and senior high portions of the computer literacy program were developed during the 1982-83 school year and are being piloted in selected schools throughout the province commencing in September, 1983.

RATIONALE AND PHILOSOPHY

For thirty years there has been a steady improvement in the performance of digital electronic components and a corresponding growth in the power of computer systems. The development and widespread use of large-scale integrated circuits that can be mass produced for a few cents has made it possible to build computers and other microelectronic systems in large numbers at low enough costs to open a mass market. The cost-effectiveness of computing has increased more than a million times in the period following World War II.

During the next few years, microelectronic intelligence is likely to be incorporated into a large number of household and industrial products. Many of these products will become linked together by a worldwide communications system into a vast network that will dominate our lives and fundamentally change the world in which we live. Humankind is witnessing the transformation of the industrial society based upon energy into the electronic society based upon information.

This transformation is creating the greatest occupational upheaval in history. Many people will emerge from this upheaval permanently unemployable. At the same time, there will be a critical shortage of advanced skills, most of them associated with microprocessors and their applications. There will be a need for the entire population to be computer literate, and <u>unless such literacy is imparted from early childhood, a substantial part of the population may find that they lack the basic skills needed to get along in their daily lives.</u>

As the specific skills, knowledge and attitudes required to be computer literate will vary with time and with the students' level of computer expertise, the definition of computer literacy should remain flexible and dynamic. The following functional definition presents the elements that form the basis for the provincial computer literacy program:

> *To be computer literate one must be able to describe, demonstrate and/or discuss (critically) how computers are used; how computers do their work; how computers are programmed; how to use a computer and how computers affect our society.*

The computer literacy program is based upon the following philosophical assumptions:

- as computer literacy is an aspect of general literacy required to function in our information-based society, all students should have the opportunity to become computer literate;

- since computers affect all subject areas, computer literacy should not be considered the specialization of one subject or group of educators. Interdisciplinary content and examples from various subject fields should be incorporated into the program;

- to become computer literate, each student must have "hands-on" computer experience;

- computer literacy encompasses three dimensions: awareness, function and critical understanding. These dimensions should be introduced to students in a manner appropriate to their developmental and ability levels. Although all dimensions should be addressed at each level, the elementary school unit should place a strong emphasis on an overall awareness of computers in society, including their applications in everyday life. The junior high component should foster a functional or working knowledge of computers and their capabilities for problem-solving. At the senior high level, the program should stress critical understanding of the implications and effects of the use of computers in society and how computers can directly and indirectly affect the individual.

The dimensions of computer literacy to be emphasized at each of the three levels of schooling are depicted in the continuum below:

ELEMENTARY	JUNIOR HIGH	SENIOR HIGH

CRITICAL
UNDERSTANDING

FUNCTION

AWARENESS
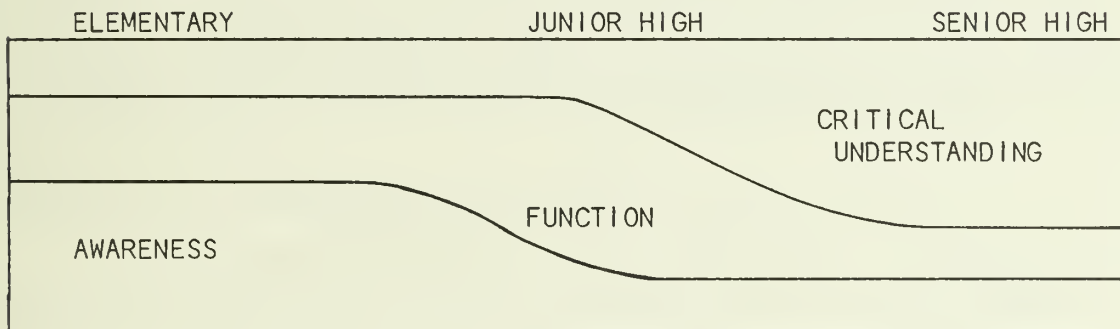
MAJOR GOALS OF THE COMPUTER LITERACY PROGRAM

The elementary computer literacy unit is designed to contribute to the achievement of the goal- for computer literacy in Alberta.

1.   To develop student understanding of basic computer operations and terminology.

2.   To develop an appreciation of the technological development of computer systems.

3.   To develop student skills, attitudes and interests which facilitate the use of computer systems.

4.   To have students appreciate that effective problem-solving with computer systems requires the application of logical thought processes and develop the skills required for a holistic, systematic approach to problem-solving.

5.   To have students appraise the applications, limitations and capabilities of computer systems.

6.   To have students assess the current and potential impact of computer systems on society.

7.   To develop student skills, attitudes and interests that will facilitate adaptation to changes in the workplace due to technological developments.

8.   To promote a greater understanding and increase utilization of computer technology in other subject areas.

Students should be given the opportunity to explore as widely as possible, and be encouraged to pursue investigative activities based upon personal goals and interests.

THE ELEMENTARY SCHOOL UNIT

It is important that educators recognize the distinction between "computer literacy" and "computer programming". In an information society, the majority of the population must be informed computer users rather than computer programmers. The elementary school computer literacy unit is designed to foster the development of computer literate students and should not emphasize computer programming skills. The availability of software in the classroom will facilitate "hands-on" experiences and the development of intelligent computer users without having students engage in extensive programming activities during regularly scheduled computer literacy time. Opportunities for additional programming activities may be provided by the teacher to selected students through special projects in other subject areas, through the formation of a Computer Club and/or by scheduling students on the computer before and after school or during the noon hour at the discretion of the teacher.

Examples of software that may be used to develop skills applicable to various subject areas are included in Section III of this guide and resources for using the LOGO language are listed in Section IV.

APPROACHES TO COMPUTER LITERACY

There are two major means of implementing the computer literacy unit: the discrete approach and the integration (fusion) approach. The approach utilized in a school district or a school should be based upon careful consideration of local conditions such as the number of teachers able to teach the unit, the hardware requirements for each approach, and the advantages and disadvantages of each approach as outlined below.

Discrete Unit Approach

Although the discrete unit should incorporate a multi-disciplinary approach, it is scheduled as a separate curriculum module within the elementary school program. In this implementation, a discrete unit called "Computer Literacy" could be taught in unassigned time in one or more grade levels, or in one subject in one or more grade levels. This allows the teacher and student, new to computer concepts, to become computer literate in one setting rather than being asked to use the computer in various subjects without a background of the capabilities, limitations and overall functions of the computer. The discrete unit approach would require less hardware, inservice for fewer teachers, fewer administrative changes (e.g. timetabling), and would be easier to implement in schools that are departmentalized or where only one or two teachers have basic computer skills or an interest in computers.

With the discrete unit approach, however, computer literacy is isolated rather than integrated with other subject area knowledge

and skills, the computer skills may become identified with a specified subject, fewer teachers may become computer literate, and more time must be obtained from the time allotments specified in the Elementary Program of Studies.

Integration (Fusion) Approach

In this implementation strategy, computer literacy objectives are integrated into the existing curricula in two or more subject areas. This approach permits a more universal access to computer knowledge and skills, providing all students with the opportunity to use computers in subject area learning in a manner and context that is clearly relevant to the student's work. Less content must be altered/deleted in each subject area to include the computer literacy skills, less time must be utilized from the elementary school program, and more teachers would become computer literate.

The integration approach requires the participation of many people at the local level, additional hardware, and more inservice to achieve a basic level of computer literacy on the part of many curriculum specialists and teachers.

The correlation between the Integrated Approach and specific content/skills in other subject areas is indicated under CORE COMPONENTS.

Two teaching units have been developed by Alberta Education to facilitate the implementation of both the Discrete and the Integrated approach to computer literacy (see Section III).

IMPLEMENTATION IMPLICATIONS

INSERVICE

Although teachers do not have to be computer experts in order to implement the elementary computer literacy unit, a brief inservice for teachers who are inexperienced in the use of computers is required. It is recommended that teachers inexperienced in the use of computers attend a one to two day "hands-on" inservice prior to beginning the unit, and that another day of inservice be offered later in the school year. Appendix 1 of this guide provides an example of the concepts/skills that should be covered during this inservice for inexperienced teachers.

For teachers experienced in the use of computers, a brief introduction to the Elementary Computer Literacy Teaching Units developed by Alberta Education (see Section III), conducted by teachers who have used the units, has proven useful, but not essential, as the units contain clear instructions for each activity. Experienced teachers may benefit from an inservice that features a review of software, an introduction to the LOGO language, or the use of a software applications program such as a word processor suitable for Division II students.

HARDWARE REQUIREMENTS

The implementation of the computer literacy units in an elementary school with limited hardware units may restrict the use of the hardware for Computer Assisted Instruction (CAI) and other computer related activities. The allocation of scarce hardware resources should be considered when determining if the computer literacy unit should be taught at one grade level or spread over two or three grades.

Although a hardware unit with limited memory and capabilities could be used to achieve the programming objectives of the elementary computer literacy unit, the computer literacy program stresses applications and CAI software that integrates the unit with current curricula in other subject areas. The use of software requires a more capable hardware unit with 48 to 64K of memory and a disk drive.

The minimum hardware requirements to teach the CORE objectives of the elementary units on a ten month (school year) basis are indicated below.

Discrete Unit

   i)   If the entire unit is taught at one grade level, one
        hardware unit should be dedicated on a half time basis to
        each computer literacy class.

   ii) If the program is spread over two or three grade levels,
        one hardware unit could be shared among four or six
        classrooms during one school year.

Integrated Unit

   i)   If the entire unit is taught at one grade level, one
        hardware unit should be dedicated on a full time basis to
        each computer literacy class.

   ii) If the unit is spread over two or three years, one
        hardware unit could be shared among two or three classes.

An alternative approach is to provide each computer literacy class with access to a computer lab with five or more hardware units for 30 to 35 minutes weekly during the teaching of the unit or sections of the unit if the unit is spread over two or three grade levels. This lab could also be used by other classes in the school for CAI and other computer-related activities.

The above hardware requirements are not sufficient if:

1. many of the students in a class are of below average ability;

2. class size exceeds 25 students;

3. students complete activities beyond the Core unit (e.g. challenge or enrichment activities);

4. equipment breakdown prevents scheduled access to the hardware;

5. the teacher finds the computer in the classroom very distracting and cannot schedule the students on the computer on a continuous basis throughout the school day;

6. the teacher is unwilling to devote considerable time to organizing classroom activities to facilitate maximum access to the computer.

SOFTWARE REQUIREMENTS

Although no software resources are designated as Prescribed Resources for the elementary computer literacy unit, it is important that appropriate software be available to allow "hands-on" computer experiences without having students engage in extensive computer programming during class time that is scheduled for the computer literacy unit (see SOFTWARE in Section III and LOGO resources in Section IV).

SELECTION OF GRADE LEVEL

Although the unit may be taught in its entirety at grade 4, 5 or 6, some students in grade 4 may experience difficulties or require more time to complete some of the concepts in Topic 3 of the unit (Computer Programming), especially when using the BASIC language. Please refer to the CORE COMPONENTS in this section to determine the objectives most appropriate for each of the grade levels in Division II.

The elementary computer literacy unit is designed for Division II. All students using the computer in the school should achieve the objectives specified in "How To Use A Computer" (Topic 2). This will minimize damage to hardware and software.

MAJOR TOPICS

The elementary school unit includes the following topics:

    Topic 1: How Computers Do Their Work
    Topic 2: How To Use A Computer
    Topic 3: How To Make Computers Work For You
    Topic 4: How Computers Are Used and What They Can and Cannot Do
    Topic 5: How Computers Affect Our Society

The elementary unit concentrates on developing an overall awareness of computers, including a reduction of the mystique surrounding computers. Emphasis is placed upon a person's ability to control the computer. The emphasis on programming skills should occur at the junior high level of the computer literacy program.

Teachers should include interdisciplinary content and examples from various subject fields during the implementation of the unit, and should sequence content to maximize the use of available hardware. The topics are not arranged in sequential order although students should be familiar with computer system operations (Topic 2) prior to entering programs on the computer (Topic 3).

TIME REQUIREMENTS

The unit should comprise a maximum of 30 hours of instructional time. This time allocation should include BOTH teacher instructional time and student "hands-on" computer time (i.e. each student should receive a total of 30 hours of instruction and "hands-on" time). Each student should be allowed approximately 6 to 8 hours to cover the CORE "hands-on" requirements.

As the unit is designed to foster an overall awareness of computers, approximately one-fifth of the 30 hours (6 hours) should be devoted to each of the 5 topics.

The unit may be taught as a 30 hour module in one grade or spread over all three grades at the Division II level. The objectives suggested for each of the Division II grades, based upon their appropriateness for the maturity level of the students, are indicated in CORE COMPONENTS. The following chart summarizes the recommended time allocations and objectives for each topic and grade.

	Topic	Gr. 4	Gr. 5	Gr. 6	Total Hours
No. of Hours Objectives	1	5 1.1-1.4 1.6-1.10	1 1.5	0	6
No. of Hours Objectives	2	2 2.1-2.4	3 2.1-2.4	1 2.1-2.4	6
No. of Hours Objectives	3	0	6 3.1-3.5	0	6
No. of Hours Objectives	4	3 4.1-4.2	0	3 4.3-4.5	6
No. of Hours Objectives	5	0	0	6 5.1-5.3	6
Total Hours		10	10	10	30

As the unit is an optional module, time could be made available for the unit through the following means:

Discrete Unit:

    i)   through the 20% unassigned time permitted in the Elementary
         Program of Studies in one, two or three grades;

   ii)   through regular program time by selecting time from the
         elective portion of the core subject areas;

  iii)   through a combination of the above.

Integrated Unit

    i)   by correlating the unit with other subject area content in
          one, two or three grade levels as indicated in the section
          CORE COMPONENTS, and

   ii)   by teaching in unassigned time or elective time in other
          subject areas in one, two or three grades, those computer
          literacy objectives that cannot be correlated with the Core
          components of other subject areas.

   The CORE COMPONENTS of the elementary computer literacy unit, the
   recommended grade level for each objective if the unit is spread
   over three grade levels, and the correlation of the computer
   literacy objectives with other subject areas are indicated on the
   following pages.

CORE
COMPONENTS

CORE COMPONENTS

Topic 1: How computers do their work

Goals: 1. To develop student understanding of basic computer
            operations and terminology.
        2. To develop an appreciation of the technological
            development of computer systems.

OBJECTIVES	DIMENSION STATUS	GRADE 4	5	6	SUBJECT CORRELATION SOCIAL STUDIES/LANGUAGE ARTS/MATHEMATICS
The student will:					
1.0 DESCRIBE THE BASIC OPERATIONS AND HISTORY OF COMPUTER SYSTEMS					
1.1 Identify the major parts of a computer.	A	X			1.1 - 1.3 Language Arts - Grades 4, 5, 6 - Read increasingly complex material with fluency; speak/write fluently about increasingly complex subjects.
1.2 Describe in his/ her words the terms "hardware" and "software" and list examples of each.	A	X			Demonstrate continuing growth in oral/written vocabulary (breadth and depth) by using: increasingly precise vocabulary.
1.3 Describe in his/ her words what is meant by "input" and "output" and give examples of each.	A	X			
1.4 Recognize that a computer gets instructions from a program written by a person.	A	X			1.4 Language Arts - Grades 4, 5, 6 - Identify and infer relationships, e.g. time, cause and effect.

NOTE: Dimension Codes   -- A = Awareness; F = Function;
                            U = Critical Understanding.
       Hands-On Required -- *
       Recommended grade if unit is taught across Division II grades -- X

OBJECTIVES	DIMENSION STATUS	GRADE 4	GRADE 5	GRADE 6	SUBJECT CORRELATION SOCIAL STUDIES/LANGUAGE ARTS/MATHEMATICS
1.5 Identify the similarities and differences among computers, calculators and electronic games.	A		X		1.5 Math - Use a calculator and a computer as a computational tool in problem-solving situations (Appendix IV, Elementary Mathematics Curriculum Guide, 1982). - Use a calculator and a computer in Extension and Enrichment activities (10% allocation of Math time).
1.6 Recognize that computers are best suited to tasks requiring speed, accuracy, repeated operations and processing of large amounts data.	A	X			
1.7 Recognize the rapid changes in computer capabilities since the 1940's.	A	X			1.7 Social Studies - Topic 4B - Inquiry Questions 7 and 8: 7. What are some ways in which lifestyles today differ from lifestyles during the settlement era, the Great Depression and World War II? Are there differences in such areas as employment, leisure time activities, education and availability of material goods? 8. What might life be like when today's grade four students are adults? Might there be new and different kinds of occupations, leisure time activities and ways to learn new skills?
1.8 Explain the basic operation of a computer in terms of input, processing and output of data.	A	X			1.8 Language Arts - Grades 4, 5, 6 - Speak/write fluently about increasingly complex subjects.
1.9 Recognize the relationship of input to the result or output.	A	X			1.9 Math - Step 4 in the Problem-Solving process (assess the process on the basis of the answer or resulting product).
1.10 Recognize that people control what computers do.	A	X			1.10 Language Arts - Grades 4, 5, 6 - Identify and infer relationships e.g. cause and effect.
	Hours	5	1	0	

Topic 2: How to use a computer

Goal: To develop student skills, attitudes and interests which facilitate the use of computer systems.

OBJECTIVES	DIMENSION STATUS	GRADE 4	GRADE 5	GRADE 6	SUBJECT CORRELATION SOCIAL STUDIES/LANGUAGE ARTS/MATHEMATICS
The student will:					
2.0 USE A COMPUTER SYSTEM					Computer Literacy objectives 2.1-2.4, inclusive.
2.1 Use a prepared program in a computer.	F*	X	X	X	All Subjects - Use available evaluated courseware to achieve objectives specified for selected subject areas (see Section III - Software).
2.2 Show respect and responsibility for equipment and other users' materials (e.g. follow safety and scheduling rules).	AF*	X	X	X	Social Studies - Grades 4, 5, 6 - Use a word processor to develop some of the communication skills specified under "Participation Skills". Language Arts - Grades 4, 5, 6 - Use a word processor to write -- well-organized paragraphs, apply proofreading skills with increasing competence, prepare a simple bibliography acknowledging author, title --- of book.
2.3 Use system commands to load and run programs.	F*	X	X	X	2.2 Social Studies - Grades 4, 5, 6 - Develop some of the group decision-making skills specified under "Participation Skills" when establishing scheduling and safety rules for computer use.
2.4 Feel confident about his/her ability to use and control computers.	AF*	X	X	X	
	Hours	2	3	1	

Topic 3: How to make computers work for you

Goal: To have students appreciate that effective problem-solving
          with computer systems requires the application of logical
          thought processes and develop the skills required for a
          holistic, systematic approach to problem-solving.

OBJECTIVES	DIMENSION STATUS	GRADE			SUBJECT CORRELATION SOCIAL STUDIES/LANGUAGE ARTS/MATHEMATICS
		4	5	6	
The student will:					
3.0 FOLLOW AN ORDERLY SEQUENCE OF STEPS TO DEVELOP A COMPUTER PROGRAM TO SOLVE A PARTICULAR PROBLEM					
3.1 Recognize that a computer program is an ordered series of instructions that allows a computer to perform tasks.	A		X		3.1 - 3.5 Math - Grades 4, 5, 6 - Apply problem-solving strategies to create a simple computer program that solves a word problem specified in one of the Prescribed Resources. OR Use the LOGO language to facilitate problem-solving to attain the specified Geometry objectives. OR
3.2 Order specific steps in a procedure to accomplish a task.	F		X		Use the LOGO language for Enrichment and Extension Topic: Networks. 3.2 and 3.3 Language Arts - Grades 4,.5, 6 - Demonstrate growth in thought processes by perceiving and comprehending increasingly complex spoken and/ or illustrated: sequence.
3.3 Find and correct errors in a procedure to perform a task.	F		X		Demonstrate growth in thought processes by perceiving and comprehending increasingly complex written and/or illustrated: sequence. Demonstrate growth in thought processes by expressing orally increasingly complex: sequence.
3.4 Create and save a simple computer program.	F*		X		Demonstrate growth in thought processes by expressing in writing increasingly complex: sequence.
3.5 Check computer output to ensure results are reasonable.	F*		X		3.5 Language Arts - Grades 4, 5, 6 - Read/view increasingly complex material critically to evaluate or judge ideas.
	Hours	0	6	0	

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Topic 4: How computers are used and what they can and cannot do

Goal: To have students appraise the applications, limitations and capabilities of computer.

OBJECTIVES	DIMENSION STATUS	GRADE 4	GRADE 5	GRADE 6	SUBJECT CORRELATION SOCIAL STUDIES/LANGUAGE ARTS/MATHEMATICS
The student will:					
4.0 DESCRIBE THE BASIC APPLICA-TIONS, LIMITA-TIONS, AND CAPABILITIES OF COMPUTERS.					
4.1 Identify the areas in society where computers are used (e.g. banking, manufacturing, transportation, medicine, recreation, the home, the library, publishing, creative arts, education).	A	X			4.1 and 4.2 Social Studies - Topic 4A - Inquiry Question 6: 6. How has technology assisted in the location, development and use of natural resources in Alberta? - Topic 4B - Inquiry Question 7: 7. What are some ways in which lifestyles today differ from lifestyles during the settlement era, the Great Depression and World War II? Are there differences in such areas as employment, leisure time activities, education, and availability of material goods?
4.2 Identify the tasks performed by computers in these areas.	A	X			- Topic 4C - Inquiry Question 4: 4. What transportation and communication links are used to connect Alberta to the rest of Canada and the world?
4.3 Recognize that computers cannot "think" in the way we normally use the word "think".	U			X	Language Arts - Grades 4, 5, 6 - Demonstrate growth in thought processes by perceiving and comprehending increasingly complex written and/or illustrated: descriptions, explanations, summaries, comparisons. Read a widening variety of material suitable to grade (four, five, six) in the following forms: report, interview.
4.4 Recognize that there are a number of things computers cannot do such as make value judgements and provide answers to every question.	U			X	Note: Comparable Language Arts objectives are also specified for Listening/Viewing, Speaking and Writing skills.
4.5 Describe the similarities and differences between computers in fiction and real computers.	U			X	4.3, 4.4 and 4.5 Language Arts - Grades 4, 5, 6 Read increasingly complex material critically to evaluate or judge ideas: discriminating fact from opinion, fiction from non-fiction, relevance from irrelevance.
Hours		3	0	3	

Topic 5:   How computers affect society

Goal: To have students assess the current and potential impact
           of computers on society.

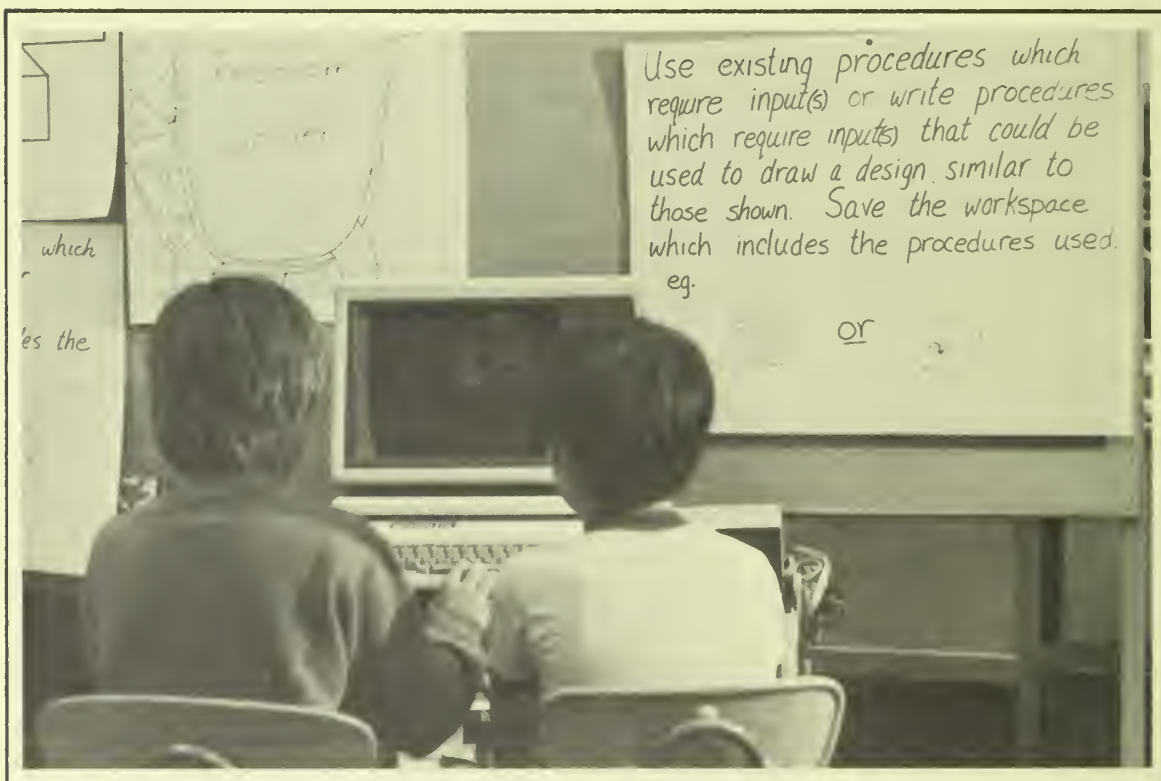| OBJECTIVES	DIMENSION STATUS	GRADE			SUBJECT CORRELATION SOCIAL STUDIES/LANGUAGE ARTS/MATHEMATICS
		4	5	6	
The student will:					
5.0 APPRECIATE THE IMPACT COMPUTERS CAN HAVE ON OUR LIFESTYLE.					5.1 and 5.3 Social Studies - Topic 4A - Inquiry Question 6: 6. How has technology assisted in the location, development and use of natural resources in Alberta?
5.1 Describe how a computer can affect him/ herself as he/ she assumes various roles, e.g. student, consumer, worker, citizen.	U			X	- Topic 4B - Inquiry Questions 7 and 8: Participation Skills 1 and 2 7. What are some ways in which lifestyles today differ from lifestyles during the settlement era, the Great Depression and World War II. Are there differences in such areas as employment, leisure time activities, education and availability of material goods? 8. What might life be like when today's grade four students are adults? Might there be new and different kinds of occupations, leisure time activities and ways to learn new skills?
5.2 Recognize that alleged "computer mistakes" are usually mistakes made by people.	U			X	1. Communicate effectively by orally expressing opinions about the use of work and leisure time. 2. Interpret ideas and feelings of others by demonstrating an understanding of different decisions made about adjustment to change at the personal level.
5.3 Recognize that computers are machines designed and operated by humans to assist in many tasks.	U			X	- Topic 4C - Inquiry Questions 4 and 7: 4. What transportation and communication links are used to connect Alberta to the rest of the world? (Consider air, rail, media networks, telecommunications, etc.) 7. How are Albertans affected by the "shrinking" nature of the modern world? - Topic 5B - Inquiry Question 6: 6. What forms of employment are associated with resource development? - Topic 5C - Inquiry Question 4: 4. What are some of the important linkages that exist today between Canada and the United States? (Consider economic, political, and cultural affairs.)
	Hours	0	0	6	

OBJECTIVES	DIMENSION STATUS	GRADE 4	5	6	SUBJECT CORRELATION SOCIAL STUDIES/LANGUAGE ARTS/MATHEMATICS
					- Topic 6B - Inquiry Questions 5 and 6: 5. What problems do Eastern societies face for which Western technology might provide partial solutions? 6. What problems do Western societies face for which Eastern societies might provide partial solutions? 5.1, 5.2 and 5.3 Language Arts - Grades 4, 5, 6 - Speak/write fluently about increasingly complex subjects.

Use existing procedures which require input(s) or write procedures which require inputs) that could be used to draw a design similar to those shown. Save the workspace which includes the procedures used.
eg.

or

METHODOLOGY

Since the recommended hardware is substantially less than the number of students, all students will not be engaged in the same activity at the same time. A portion of the work students will complete at the computer many be done in small groups of two or three. This may reduce frustration among students who are experiencing difficulties working with the computer, develop interpersonal skills, and assist students in arriving at solutions to problems that might otherwise require teacher intervention. The group method is time and cost effective, and may contribute to a more positive attitude towards computers.

Unless the class has access to a computer lab, individual students may also have to be scheduled for their "hands-on" activities while the rest of the class is completing assignments or independent work in other subject areas. Each student should assume responsibility for completing any work that was assigned while the student was working at the computer. The computer station(s) in the classroom should be located so as to minimize distraction of students engaged in other activities.

Since only a small portion of the class can be engaged in small group or independent work at the computer during the time allocated for the computer literacy unit, the rest of the students may be engaged in a variety of activities that contribute to the achievement of the objectives of the unit. Suggested activities include completion of worksheets, small group work, overhead presentations, viewing of audiovisual materials, whole class demonstrations using a computer and a large monitor, and research projects. Instructional strategies and materials should accommodate individual differences and allow students to learn at a rate with which they feel comfortable. Careful organization is essential if the classroom is to be adaptable to this variety of activities.

It is highly recommended that all students develop keyboarding skills, such as knowledge of correct position for home row and right and left hand, as early as possible in the computer literacy program in order to maximize use of available hardware. Some resources to facilitate development of keyboarding skills are listed in Section III. Software that facilitates the development of keyboarding and typing skills is also available.

A suggested methodology for implementing the computer literacy unit, including scheduling computer time, is outlined in the teaching units developed by Alberta Education (see Section III).

NOTE: All computer commands and statements used in this document and the teaching units are applicable to the APPLE II Plus computer and may require some modification when using other computer models.

STUDENT EVALUATION

Some means of evaluation that may be effectively employed for this unit include observation of student performance on the computer, pre- and post-questionnaires, evaluation of student programs and worksheets, written examinations and quizzes, student participation in classroom discussion and student projects in addition to "hands-on" computer activities (e.g. research projects, oral and written reports).

For some activities, students could check their own work from a master sheet allowing the teacher to help students who are working at the computer or on other activities. Students may also assist each other in assessing their work.

The means of evaluation should be congruent with the knowledge, skills and attitudes being tested and the content emphasis as reflected in the time allotted for each topic. For example, "hands-on" computer skills should be measured through demonstration rather than through written evaluations and approximately equal value should be given to each of the five topics in the unit.

Both of the Alberta Education teaching units described in Section III contain suggestions for evaluation of student achievement.

LEARNING RESOURCES

LEARNING RESOURCES

In terms of provincial policy, learning resources are those print, nonprint and electronic courseware materials used by teachers or students to facilitate teaching and learning.

PRESCRIBED RESOURCES

Prescribed Learning Resources are those learning resources approved by the Minister as being most appropriate for meeting the majority of goals and objectives for courses, or substantial components of courses, outlined in provincial Programs of Study.

Alberta Education has not designated any Prescribed Resources for the Elementary computer literacy unit.

RECOMMENDED RESOURCES

Recommended Learning Resources are those learning resources approved by Alberta Education because they complement Prescribed Learning Resources by making an important contribution to the attainment of one or more major goals of courses outlined in the provincial Programs of Studies.

ALBERTA EDUCATION/ACCESS PRODUCTIONS

Teaching Units

Two teaching units designed to assist in implementing the objectives of the elementary computer literacy unit were field tested in over 40 official Pilot Schools throughout Alberta during the 1982-83 school year. Revised copies of the units will be available from the School Book Branch at a reasonable price by October, 1983.

The units contains numerous core and enrichment activities with detailed instructions on methodology, student worksheets, and notes to assist the teacher with scheduling students when limited hardware is available, student evaluation, the use of both the BASIC and the LOGO language in the classroom and other ideas for implementing the computer literacy unit. One of the units is based upon the Discrete approach to computer literacy while the other unit facilitates the Integrated approach by relating the computer literacy objectives to the current Social Studies, Language Arts and Mathematics programs for Division II students.

Computer Literacy. Alberta Education/ACCESS, 1982. (Three 10-minute color videotapes.) Available from ACCESS Media Resource Centre, Calgary - BPN 236701-236703.

Programs in series:

1. COMPUTER LITERACY: Input/Output (236701)

    Describes the purpose and functions of input and output,
    giving examples of various input and output devices.
    Students will also learn how a computer functions - via
    programming instructions stored in its memory and then
    processed by the Central Processing Unit (CPU).

2. COMPUTER LITERACY: Computers, Calculators and Electronic
    Games   (236702)

    Explains how computers, calculators and electronic video
    games all have a great deal in common - as they utilize
    their input, process it and provide output.
    However, as it is pointed out here, the major differences
    lies in the program that they contain.

3. COMPUTER LITERACY: Computers and You (236703)

    Explores the impact of computers on everyday life, in places
    where they have emerged as a workable alternative. Here,
    students will see the role that computers play with
    automatic banking machines, billing procedures, grocery
    shopping, airline travel and checking out library materials.

Let Problem-Solving Be the Focus for 1980's. Curriculum Branch,
Alberta Education, 1983. Available from the School Book Branch.

    This monograph provides background information, ideas and sample
    activities to teachers in their efforts to assist students in
    developing problem-solving skills and provides an overview of the
    stages in the problem-solving model recommended in the elementary
    mathematics program of studies. Further ideas regarding
    organization of instruction, the use of textbooks, and sources of
    problems and problem-solving materials are included in the
    reference list.

COMMERCIAL RESOURCES

    Ball, Marion J., and Charp, Sylvia. Be a Computer Literate.
    Morris Plains, New Jersey: Creative Computing Press, 1977, 63 pp.

    This full color booklet covers kinds of computers, how they
    work, their applications in society, flowcharts and writing a
    simple program. The text is supplemented by drawings,
    diagrams and photographs.

    Cost - Approximately $4.00 (paperback).

D'Ignazio, Fred. The Star Wars Question and Answer Book About Computers. New York: Lucasfilm Ltd., 1983, 61 pp. Canadian Distributor: Random House of Canada.

> Through its question-and-answer format with numerous full color visuals, this resource presents information on how computers work, their history and internal composition, and their numerous and varied uses in robots, games, the movie industry, the human body, space shuttles, and the world of the future.

> Cost - Approximately $7.00 (paperback)

Hughes, Monica. The Tomorrow City. London: Methuen Children's Books Ltd., 1982, 137 pp. (Fiction). Canadian Distributor: Methuen Publications.

> "The Tomorrow City is about Edmonton, not just because it is set here, but because the story was born at Vista 33, the viewing gallery at the top of the Alberta Telephone Tower, one night when we were showing the city to out-of-town friends. I saw Edmonton at night in a new way, as a network of lights, seeming to radiate, from the 'centre' where I stood, out to the extreme boundaries.

> I imagined this network as a nervous system connected to the tower, and I thought of 'the City as a Brain'. I grabbed this passing idea and knew I had to use reason, logic and imagination to develop a believable plot.

> The 'City as Brain' made no sense, but the 'City as Computer' certainly did. I began to imagine a city in which the day-to-day decision-making was in the hands of a computer, not an evil computer--there's no such thing--but a special computer designed with the goal of providing a beautiful and safe environment for children."

> (By Monica Hughes)

> Although designed for junior high school students, this story may be read aloud to younger students or enjoyed as an independent reading project by students with more advanced reading skills. It is recommended that each teacher judge the appropriateness of this resource for his/her students and proceed accordingly.

> Cost - Approximately $3.50 (paperback)

Methuen has also published a Teacher's Idea Package and Student Worksheets to the Science Fiction Novels of Monica Hughes which includes a section on The Tomorrow City and the other books by Monica Hughes listed under Supplementary Resources.

Cost - Approximately $7.00

Jacobsen, Karen. Computers. Chicago, Illinois: Childrens Press, 1982, 48 pp. Canadian Distributor: Alberta Book and Novelty (1982) Ltd.

The logical organization, large print and high quality full color photographs of this hardcover book provide an attractive and readable introduction to the history, limitations, capabilities, operations and applications of computers. Glossary and Index.

Cost - Approximately $10.00 (hardcover)

Rice, Jean. My Friend - The Computer. Minneapolis, Minnesota: T.S. Denison and Company, Inc., 1981. Student Text and Teacher's Guide. Student Text - 96 pp.; Teacher's Guide - 110 pp.

This comprehensive program, designed for use in elementary school classrooms with or without computer equipment, facilitates the logical development of both affective and cognitive concepts and skills, including familiarity with computer terminology, distinctions between truths and misconceptions about a computer, computer applications in everyday life, information processing techniques, logical thought processes, creation of simple computer programs, and development of positive feelings about a computer. A multimedia bibliography, 40 Duplicating Masters, evaluation means and detailed lesson plans are included in the Teacher's Guide.

Cost - Student Text - $5.00 (paperback)
     - Teacher's Guide - $15.00 (paperback)

Note: Teachers using the LOGO language, should also select resources listed in Section IV.

SUPPLEMENTARY RESOURCES

Supplementary Learning Resources are those additional resources
identified by teachers, school boards or Alberta Education to support
courses outlined in the provincial Programs of Study by reinforcing or
enriching the learning experience.

> "The Supplementary Learning Resources listed
> have not necessarily been subjected to the
> same intensive evaluation process that is
> applied to Prescribed or Recommended Learning
> Resources and no formal, departmental approval
> should be implied. The titles listed have
> been identified as a means to facilitate local
> selection of learning resources, but the
> responsibility for evaluation prior to
> acquisition rests with local jurisdictions."

Bitter, Gary G.   Exploring With Computers. New York, New York:
Julian Messner, 1981, 64 pp. Canadian Distributor: General
Publishing Co. Limited.

   This resource, which discusses how computers work, their
   types, uses, misuses, computers of the future, and careers in
   the field may be useful for research projects by good readers.
   Computer-related activities (no hardware required) and an
   index are included.

Court, Rosemary. Sam's System. London, Great Britain: J.M. Dent
& Sons Ltd., 1982, 48 pp. Canadian Distributor: Fitzhenry &
Whiteside Ltd.

   A storybook approach is employed to provide an excellent
   explanation of the basic components of a computer system, the
   input-processing-output sequence, and the relationship of
   microcomputers to larger computers with emphasis on
   similarities and differences. A comparison of the computer to
   the human brain is also included.

Creative Programming for Young Minds. Charlestown, Illinois:
Creative Programming Inc. (8 books).

   The volumes in this series, designed to provide a progressive
   introduction to programming in the BASIC language, may be used
   for enrichment and Computer Club activities.

D'Ignazio, Fred. Katie and the Computer. Morris Plains, New
Jersey: Creative Computing Press, 1979, 32 pp.

   Using a storybook format with full color illustrations, this
   resource explains how a computer works. Katie "falls" inside
   her Dad's home computer where she journeys through Cybernia
   meeting Software Colonel, the Bytes, the Table Manager and

even a ferocious Program Bug. Although designed for children from 4 to 10 years old, young children may be confused by the computer jargon. For older children, Katie's journey portrays the inner workings of a computer in a reasonably accurate manner with further explanations of computing terms on the inside of the front and back covers.

Engelmeyer, William J., and Patrick, Ann. Learning About Computers. Baltimore, Maryland: Hampden Publications, Inc. (Hampden Skill Pack 5884) (Multimedia Kit containing 10 audio-cassettes, 10 lesson guides, 10 post tests, 300 student response booklets). Canadian Distributor: McIntyre Educational Media Ltd.

The 10 lessons in this skill pack introduce computer concepts through a multimedia approach to ten topics: what a computer is, some ways computers are used, how computers work, computer vocabulary, getting information into the computer, getting information out of a computer, flowcharts, computer languages, reading computer symbols, and simple programming in BASIC. The kit contains 30 identical consummable student response booklets, an audiocassette tape, a brief teacher's guide and a reproducible post test for each of the ten topics. The diagrams are excellent and the activities, if used selectively over a period of time for whole class or independent study, will contribute to the achievement of the objectives of the Alberta elementary computer literacy unit. Experienced teachers may not require the use of the audiotapes. Due to its cost, this resource should be considered for purchase by a school jurisdiction central resource centre and circulated among several schools.

Friedman, Batya, and Slesnick, Twila. Creative Play: Problem-Solving Activities With the Computer. Berkeley, California: Lawrence Hall of Science, 1982. (One Teacher's Guide, one DOS 3.3 disk for 48K Apple II or Apple II Plus computer.)

A set of 25 programs on the diskette introduces children to using computers and focuses on interdisciplinary problem-solving. The programs include number and word games, simulations, mazes, map reading and secret messages. The teacher's guide contains a rationale, materials, additional activities and worksheets correlated with selected computer programs. This resource has been designated "Supplementary" pending further evaluation by the Office of Computer Technology, Alberta Education.

Friedman, Batya, and Slesnick, Twila. Teaching BASIC Bit By Bit: A Curriculum for Introducing Computers and Programming in the Modern Classroom. Rev. Ed. Berkeley, California: Lawrence Hall of Science, 1981, 166 pp.

Written as a manual for teachers to use in introducing BASIC programming to their students, this resource introduces

global programming concepts, followed by examples from BASIC. Students are encouraged to experiment with the computer and to use it as a tool to discover the exact meaning and limitations of individual BASIC statements. Both individual and group activities are included.

Gatland, Kenneth, and Jefferis, David. Robots. (World of the Future Series) London, Great Britain: Usborne Publishing Ltd., 1979, 32 pp. Canadian Distributor: Hayes Publishing Ltd. and The Learning Tree.

> Excellent explanations of how robots, intelligent machines using advanced computer systems as their "brains", will help humankind run an increasingly complex world are presented through full color illustrations and text in this British book. Major topics include energy and resources, ecology and agriculture, health and medicine, and science and technology. There is a glossary and an index.

> Other titles in this World of the Future series by the same authors include Future Cities and Star Travel. The three titles are also available in a collection titled the Usborne Book of the Future.

Graham, Ian. Usborne Guide to Computer and Video Games. London, Great Britain: Usborne Publishing Ltd., 1982, 48 pp. Canadian Distributor: The Learning Tree and Hayes Publishing Ltd.

> This book provides a colorful and appealing introduction to past, present and future computer and video games, along with tips on how to win some popular games and a computer glossary.

Hughes, Monica. The Keeper of the Isis Light. London, Great Britain: Hamish Hamilton, 1980, 136 pp. Canadian Distributor: Van Nostrand Reinhold Publishers (hardcover); Methuen Publications (paperback).

> For sixteen years Olwen has lived on Isis with only Guardian for company. Then comes the news that a spaceship with eighty settlers on board is about to land. Olwen is nervous at the thought of so many strange people. What will they think of her, Guardian, and her precious planet, Isis? Guardian has been "mother and father and friend and teacher and counsellor" to Isis who does not realize that Guardian is actually Data Collector and Processor Forty-Three, a super robot! Although written for young adults, this novel has a grade 5-6 reading level and could be enjoyed by students in the upper elementary grades.

> NOTE: This novel is part of a trilogy that includes Guardian of Isis and The Isis Pedlar.

Keyboarding for Computer Literacy At the Elementary School Level.
White Bear Lake, Minnesota: Minnesota Curriculum Services Center,
1983, 21 pp.

    This brief document was designed for instructors,
    administrators and other educational personnel involved in
    decision-making for future keyboarding and computer related
    courses. The two major sections of the document cover
    considerations for setting up the course and a day-to-day
    instructor's guide for the seven-week program.

Larsen, Sally Greenwood. Computers for Kids. (Apple, Atari,
TRS-80, Sinclair ZX-81 editions available.) Morris Plains, New
Jersey: Creative Computing Press, 1980-81, 55 pp.

    This BASIC programming manual, written for children with a
    4 page section for teachers and parents, introduces the
    student to PRINT, GOTO, INPUT, RND, IF-THEN, and FOR-NEXT
    commands. Sample programs, including graphics programs, and a
    glossary are included.

Lewis, Bruce. Meet the Computer. Dodd, Mead and Company, 1977.
47 pp. Canadian Distributor: Hollinger House Ltd.

    Through text and visuals, this resource explains what
    computers are and how they work, with emphasis on the need for
    people to program and operate them. The author is a
    communications specialist with IBM. This book would
    supplement some of the activities in the computer literacy
    unit and would be appropriate as a library resource for
    research and enrichment activities.

Lipscomb, Susan Drake, and Zuanich, Margaret Ann. BASIC Fun:
Computer Games, Puzzles, and Problems Children Can Write. Avon
Camelot, 1982, 176 pp. Canadian Distributor: Avon Books of
Canada.

    This introduction to the fundamentals of computer programming
    uses the BASIC language and includes descriptions and listings
    of programs that will challenge upper elementary school
    students.

Lipson, Shelley. It's BASIC: The ABC's of Computer Programming.
New York, New York: Holt, Rinehart and Winston, 1982, 46 pp.

    This simple introduction to computer programming covers the
    functions of a computer, mathematical operators, and the
    PRINT, LET, GOTO, INPUT and IF/THEN statements.

Milton, Joyce. Here Come the Robots. New York, New York:
Hastings House, 1981, 118 pp.

   A simple, easily read text gives historical and cultural
   background to the development of robots. It concentrates on
   publicity stunts more than on technology, but manages to
   depict major developments. The variety of possible robots is
   illustrated by several devices from the Kurzweil Reading
   Machine to the Viking Lander.

Moursund, David. Teacher's Guide to Computers in the Elementary
School. Eugene, Oregon: International Council for Computers in
Education, 1981, 48 pp.

                     Introduction to Computers in Education for
Elementary and Middle School Teachers. Eugene, Oregon:
International Council for Computers in Education, 1981.

   These resources are part of a series of books written by an
   expert in the field of educational computing. Each book
   addresses issues clearly and concisely providing explanations
   of terminology, outlining problems in the field, stressing
   advantages and disadvantages of applying computers to
   educational activities, and including examples of learning
   activities that may be used at a particular educational level.
   The resources may be most useful as part of a campaign to
   promote computer literacy among all staff members in a
   school.

Muir, Walter. Computer Awareness: An Introduction for Teachers.
Learning Assessment Branch and Curriculum Development Branch,
British Columbia Ministry of Education, 1983, 64 pp.

   Written for teachers and administrators who have had little or
   no experience with computers, this book briefly introduces the
   history and societal impact of computers, the role of software
   and hardware in computer systems, the role of computers in
   education, practical considerations for the teacher who plans
   to introduce computers in the classroom and the application of
   the computer to school administrative operations.

Nash, Kate and Geyer, Charlotte. Touch to Type Typing Program.
North Billerica, Massachusetts: Curriculum Associates, Inc., 1983
(one student text, two audiocassettes.) Canadian Distributor:
The Learning Tree.

   Using a standard keyboard layout, this resource provides
   students with practice for developing touch-typing skills on a
   typewriter and the simulated keyboard included with the text.
   The 38 lessons are presented on laminated cardboard pages in a
   coilbound text that may be folded into a standup format and
   placed besides the typewriter for ease of use. Audio
   instruction tapes guide students through the 13 introductory

lessons. The simulated keyboard and activities are color
coded to reinforce use of the correct finger for each
alphanumeric keyboard character.

Rice, Jean, and O'Connor, Sandy. Computers are Fun. Minneapolis,
Minnesota: T.S. Denison and Company, Inc., 1981. Student Text -
62 pp.; Teacher's Guide - 92 pp.

Designed for kindergarten to grade three children, this
program uses a storybook format to teach children about how
computers help us, the historical development of computers,
the parts of a computer, microcomputers, flowcharts and simple
programs. A multimedia bibliography, 27 Duplicating Masters,
a glossary and detailed lesson plans are included in the
Teacher's Guide.

Smith, Brian Reffin. Usborne Guide to Computers. London, Great
Britain: Usborne Publishing Company, 1981, 32 pp. Canadian
Distributor: The Learning Tree and Hayes Publishing Ltd.

A very current and accurate visual approach to what a computer
is, how a computer works and where computers are used is
provided by this colorful British book. The limitations and
capabilities of computers are also presented, including a
comparison of the computer and the human brain.

Spencer, Donald D. The Illustrated Computer Science Dictionary
for Young People. Ormond Beach, Florida: Camelot Publishing
Company, 1982, 128 pp.

Written for students in grades 4 to 8, this illustrated
reference book defines words, phrases and acronyms used in
connection with computers. All visuals are in black and
white.

Tatchell, Judy, and Bennett, Bill. Usborne Guide to Understanding
the Micro. London, Great Britain: Usborne Publishing Ltd., 1982,
48 pp. Canadian Distributor: The Learning Tree and Hayes
Publishing Ltd.

Colorful illustrations and a cartoon format provide a visually
appealing introduction to microcomputers: hardware, software,
silicon chips, historical development, networks, sound and
graphics, applications, buyer's guide and terminology.

Taylor, Robert, Ed. The Computer in the School: Tutor, Tool, Tutee. Teachers College, Columbia University: Teachers College Press, 1980, 274 pp. Canadian Distributor: Guidance Centre, Faculty of Education, University of Toronto.

Intended for educators and parents, this book consists of 19 essays by pioneers in the field of computers in education: Alfred Bork, Thomas Dwyer, Arthur Luehrmann, Seymour Papert, and Patrick Suppes. The essays cover a wide range of teaching and learning "to build a good foundation for understanding the basic issues involved in using computers of any kind in schools, the teacher's role in helping the student to make full use of computing, and the general limitations of computer use."
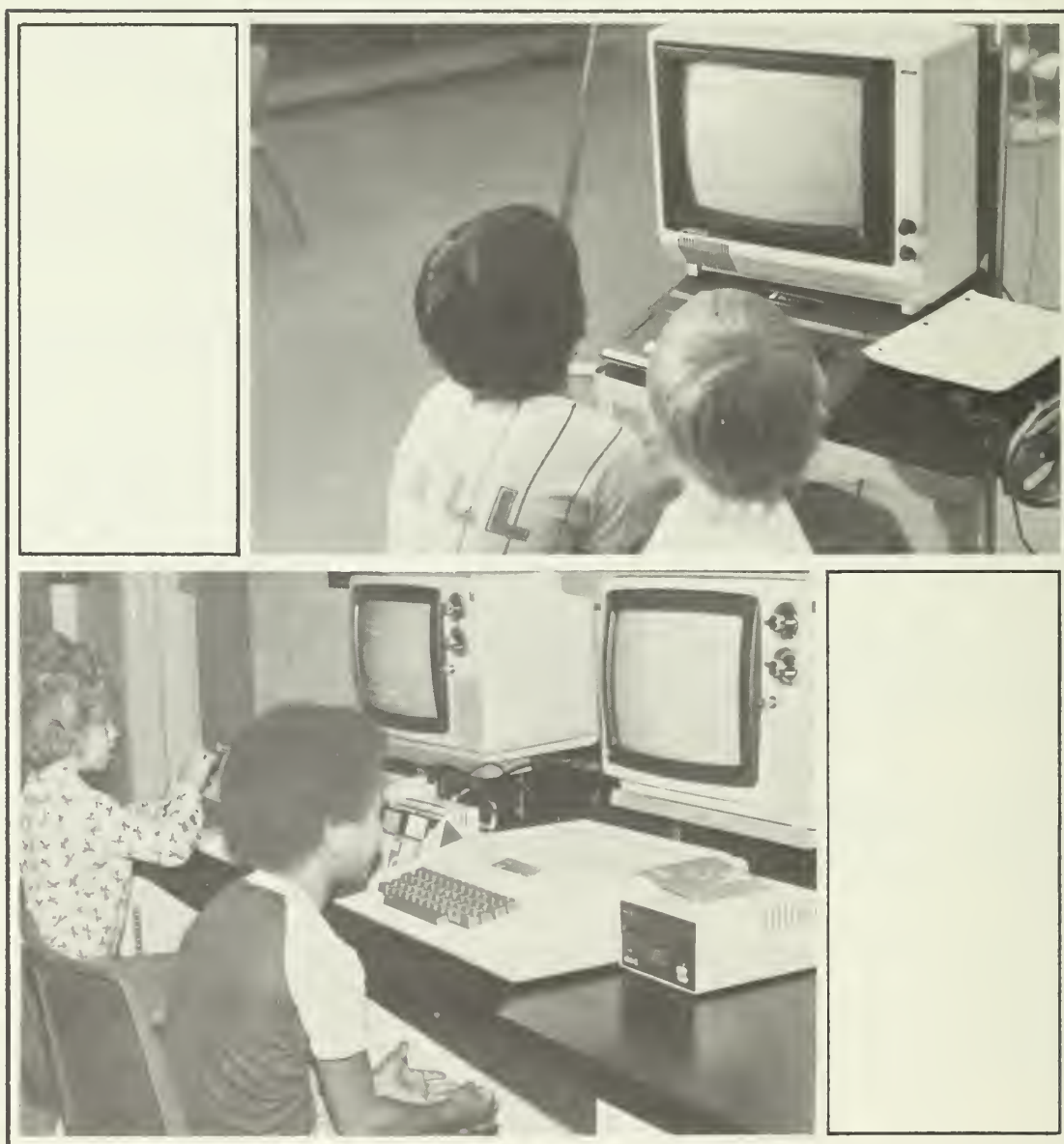
SOFTWARE

COURSEWARE FOR COMPUTER-ASSISTED INSTRUCTION

Evaluation of computer courseware and the designation of courseware items as Prescribed, Recommended or Supplementary Resources is currently a joint project of the Clearinghouse of the Computer Technology Project and the Program Development Division of Alberta Education.

During the 1982-83 school year, several Mathematics courseware packages were designated as Recommended and Supplementary Learning Resources for the elementary Mathematics program. Science courseware is being evaluated during the 1983-84 year. A series of Reports describing the status (Rejected, Prescribed, Recommended or Supplementary) of specific courseware packages is being compiled by the Clearinghouse, Computer Technology Project, 11160 Jasper Avenue, Edmonton T5K 0L2 (Phone 427-0843). These Reports should be consulted to obtain current information on appropriate courseware for Division II students.

Courseware that has been designated Recommended has been purchased and is available from the School Book Branch at a discount price. Full ordering information for Supplementary courseware is provided in the Clearinghouse Reports.

Alberta Education has also purchased a license for the Minnesota Educational Computing Consortium (MECC) software. The MECC software includes courseware for Computer Assisted Instruction at all grade levels and subject areas as well as training and utility software. By July, 1983, each school jurisdiction office should have received a large catalog describing the MECC titles and each school should have received a shorter listing of available MECC materials. The MECC courseware is available from the ACCESS Media Resource Centre in Calgary. Full details on cost and ordering information are available in the catalogs, from the Clearinghouse, and from the ACCESS Media Resource Centre.

WORD PROCESSING SOFTWARE

Word processors are versatile software applications packages that can be used to facilitate compositions in a variety of subject areas. As of August, 1983, an evaluation of word processing packages had not been completed by the Clearinghouse. However, a few simplified word processors have been successfully used with elementary school children in Alberta or other provinces of Canada. One of these packages is indicated below:

Bank Street Writer. San Rafael, California: Broderbund Software, 1982. (One Dos 3.3 disk for 48K or 64K Apple II Plus computer, manual, backup disk.) Canadian Distributor: Some local computer stores.

Developed by Bank Street College of Education for use with elementary students and/or older students who have not been exposed to word processing concepts, this simplified word processor includes a comprehensive tutorial to introduce students to the basic operations of the word processor. The three modes of the word processor allow students to WRITE, including capitalization and deletion of characters, indentation of margins, and centering of text; to EDIT, including cursor movement, additions/deletions, movement of text, and finding and replacing of word(s) in text; and to TRANSFER, including initializing a data diskette, saving documents with passwords if desired, retrieving documents, renaming and deleting documents, and printing documents. A UTILITY PROGRAM may be used to change printer parameters and to convert files to a standard Apple text file to facilitate the sending of files over a phone line.
This word processor will accept approximately 1300 words in a document if used with a 48K Apple or 3200 words for computers with a 16K RAM card.

Although the tutorial covers many of the WRITE and EDIT functions, the reading level of the presentation may pose difficulties for many students in the upper elementary grades.

A word processor selected for Division II should allow students to perform the following minimal functions:

1. Create a file containing a student composition
2. Edit the composition
3. Save the composition on a diskette
4. Load the composition from the diskette
5. Print the composition

Teachers may add additional functions according to curricular needs and student abilities, but should recognize that word processing functions should be simplified in order to facilitate rather than hinder writing tasks. The development of keyboarding skills will also facilitate the use of a word processor.

LOGO IN THE CLASSROOM
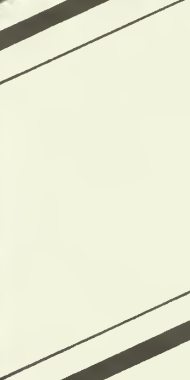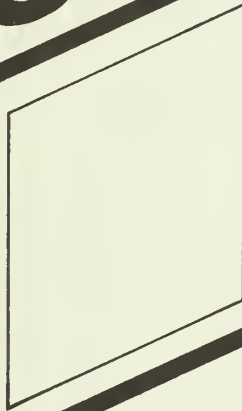
LOGO IN THE CLASSROOM

RATIONALE

The LOGO language was developed by Seymour Papert and his associates at the Massachusetts Institute of Technology in an effort to permit younger children to solve meaningful problems on the computer. The initial efforts of the developers focused on a computerized toy, a turtle, that could move around on a sheet of paper drawing geometrical shapes according to the instructions provided by the child controlling the turtle. The LOGO language moved the turtle onto the video screen by using an arrowhead to indicate the position of the turtle and the direction in which it should move. By using a series of "primitives", or simple commands like FORWARD, RIGHT, LEFT, etc., the child is able to create his/her own "procedures" which can then be manipulated to produce a variety of geometric shapes. The language is consequently almost infinitely expandable as each student may create any number of procedures to solve a problem. Computer programming with LOGO consists essentially of teaching the turtle a new word (a new procedure or combination of existing procedures) or being able to communicate with the turtle and manipulate it to produce the desired image.

Even very young children are able to use and enjoy the LOGO language. It is "friendly" as its statements are in plain English rather than computerized jargon, and it is immediate - commands are carried out as they are given. LOGO provides a means for children to learn about computers and programming, but, more importantly, about logical thinking and problem-solving. By designing individualized procedures, each child may interact with the computer using commands that are fully comprehensible and designed to meet his/her unique abilities and interests. Children learn to control the computer through structured programming techniques employing procedures arranged in logical sequences. The LOGO language may be employed to achieve many of the geometry objectives specified in the elementary Mathematics Program of Studies.

LOGO RESOURCES

LOGO Language Packages

> A LOGO language package and 64K of RAM are required to implement LOGO on an Apple II computer. A 16K RAM card must be inserted in the Apple II Plus computer to obtain 64K RAM, but this additional card is not required for the 64K Apple IIE computer. The approximate cost of the LOGO language package is $225.00. The Apple LOGO packages currently available include the following:

Apple LOGO. Pointe Claire, Quebec: LOGO Computer Systems Inc.
Canadian Distributor: local computer stores licensed to sell
Apple products.

> Contents: One master diskette, one backup diskette, two
> manuals (Apple LOGO: An Introduction to Programming Through
> Turtle Graphics, 153 pp.; Apple LOGO: Reference Manual,
> 186 pp.)

Krell LOGO. Stony Brook, New York: Krell Software Corporation.

> Contents: One master diskette, one backup diskette, one
> utilities diskette, one Alice in Logoland diskette, four
> manuals (LOGO for the Apple II: Technical Manual by Harold
> Abelson and Leigh Klotz, 55 pp.; LOGO for the Apple II by
> Harold Abelson, 228 pp.; Teacher's Manual, Alice in Logoland
> Primer), one poster-sized summary sheet for Krell LOGO, and a
> one year (5 issue) subscription to The LOGO Educational
> Computing Journal.

Terrapin LOGO. Cambridge, Massachusetts: Terrapin Inc. Canadian
Distributor: Trinity Ventures.

> Contents: One master diskette (backup available for nominal
> fee), one utilities diskette, two manuals (Terrapin Logo
> Tutorial, 86 pp.; LOGO for the Apple II: Technical Manual
> by Harold Abelson and Leigh Klotz, 55 pp.)

LOGO References

> NOTE: Many articles on the LOGO language are being published in
> current computer periodicals (see Appendix 3) while additional
> information is available through various LOGO user groups.
> Several of the resources listed below contain bibliographies of
> additional LOGO resources. Alberta Education is also developing a
> monograph on LOGO which will be available from the School Book
> Branch in late 1983.

Apple LOGO in the Classroom. Minneapolis, Minnesota: Minnesota
Educational Computing Consortium. Available from ACCESS Media
Resource Centre, Calgary.

> The activities in this book, targeted for children in grades
> 5 to 9, are designed to help students develop general
> problem-solving strategies, develop a modular approach to
> problem-solving by dividing a problem into smaller segments,
> explore geometric concepts and properties, formulate models
> for geometric concepts using relative rather than coordinate
> geometry, control a computer through programming it, and
> practise structured programming techniques. The first three

of the ten modules (Meet the Turtle, Shapes and Patterns)
could form the Core portion of an introduction to the LOGO
language. The material for each module includes an overview,
teacher notes, student activity pages, and transparency
masters.

Bearden, Donna, and Muller, Jim. The Turtle's Sourcebook.
Richardson, Texas: Young People's LOGO Association, 1982, 84 pp.

Prepared for Texas Instruments and Apple computer users, this
resource contains specific instructions for both Apple and
Massachusetts Institute of Technology LOGO (Krell and
Terrapin). Many of the activities are congruent with the
hardware, software and sequencing objectives specified for
the Alberta elementary computer literacy unit. A sequence is
suggested for the LOGO problem-solving activities and games,
but the teacher should select activities to meet classroom
needs. The resource is under development and revisions will
be incorporated in future editions. A LOGO bibliography and
resource guide is included.

Supplementary Resources

Abelson, Harold. LOGO for the Apple II. Peterborough, New
Hampshire: BYTE/McGraw-Hill, 1982, 228 pp. Canadian Distributor:
McGraw-Hill Ryerson Limited.

This comprehensive teacher reference on the Massachusetts
Institute of Technology LOGO language includes programming
procedures; projects in Turtle Geometry; workspace, filing,
and debugging; numbers, words and lists; writing
interactive programs; inputs, outputs, and recursion;
advanced use of lists; and a glossary of LOGO primitive
commands. The appendices cover the slightly different
versions of LOGO distributed by the Apple Computer Company and
Texas Instruments, Inc. There is a bibliography of
references and an index.

Abelson, Harold, and diSessa, Andrea. Turtle Geometry: The
Computer as a Medium for Exploring Mathematics. Massachusetts
Institute of Technology: MIT Press, 1981.

This resource explores many of the possibilities of turtle
graphics, from basic shapes to the theory of relativity.

Big Trak. Milton Bradley (Toy Company).

Students can develop problem-solving skills and achieve
several computer literacy objectives through the manipulation
of this programmable robot vehicle. Programming may be
introduced as a communication tool through which the student
conveys instructions to the machine.

Papert, Seymour. Mindstorms: Children, Computers, and Powerful Ideas. New York, New York: Basic Books, Inc., Publishers, 1980, 230 pp. Canadian Distributor: Fitzhenry and Whiteside.

In this resource, Papert presents the philosophical background for using the LOGO language and explains "how computers can be carriers of powerful ideas and of the seeds of cultural change, how they can help people form new relationships with knowledge that cuts across the traditional lines separating humanities from sciences...". Papert argues that elementary children can easily learn to program and that computers can help children learn mathematics and other skills.

Thornburg, David D. Every Kid's First Book of Robots and Computers. Greensboro, North Carolina: Compute Books, 1982, 83 pp. Canadian Distributor: Holt, Rinehart and Winston of Canada Ltd.

Suitable for grades 4 to 6, this is an excellent resource to be used by teachers, parents and students to introduce children to robots and computers. Exercises presented throughout the illustrated book allow users to learn turtle graphics through the use of the Milton Bradley Big Trak robot toy, or the Turtle Tiles that are provided with each book.

Dr. Thornburg has also published Picture This II (Addison-Wesley, 1982), a book describing the Turtle graphics features of the Apple Superpilot language, and Discovering Apple Logo: An Invitation to Computer Art and Programming (Addison Wesley, 1983).

APPENDICES

APPENDIX 1

COMPUTER LITERACY INSERVICE FOR   INEXPERIENCED TEACHERS

DAY ONE

This workshop is designed as a full day session. If the LOGO language
session (Part Three) is included in addition to the session on BASIC
(Part Four), the workshop should be extended to one and a half days or
to an evening plus one full day.

Objectives: 1.   The teachers will learn the basic parts, care and
                  operation of a computer system.

             2.   The teachers will learn system commands and simple
                  programming in the BASIC and/or LOGO language.

MORNING

Parts One and Two (Half Day Session).

Part One: Getting to Know a Computer

   1.1   Parts of a Computer System (Computer Terminology) - hardware,
         software, input, memory unit, ROM, RAM, arithmetic and logic
         unit, control unit, output, microprocessor.

   1.2   Care and Handling of a Computer System - safety precautions,
         static electricity, power supply, care of the CPU and disk
         drive, guidelines for using diskettes, moving equipment.

COFFEE BREAK

Part Two: Operating a Computer with a Disk Drive.

   2.1   DOS or System Commands - booting DOS, catalog, menu, types
         of files, locked and unlocked files, file length notation,
         disk capacity, clearing screen.

   2.2   Keyboarding and Special Function keys.

   2.3   Loading and Running Programs - using appropriate software
         selected for Division II.

   2.4   Initializing a Diskette.

   2.5   Some Troubleshooting Suggestions (e.g. checking for loose
         chips, circuit boards, cable connections; confirming that power
         supply is on for all peripherals, monitor switch is in "LINE"
         position, and DOS is properly booted).

LUNCH BREAK

Part Three: Using the LOGO Language (Half Day or Evening Session).

NOTE: The commands in this section are based upon the Terrapin version
         of LOGO and may require modification when using other LOGO
         packages.

  LOGO WORKSHOP

  1.   Provide a <u>brief</u> explanation of the philosophy and development
        of the LOGO language stressing its simplicity and <u>its role in</u>
        <u>developing problem-solving skills.</u> Additional information
        could be provided through handouts.

  2.   Discuss and demonstrate the use of the most common "primitives".

        <u>Turtle Commands</u>   <u>Screen Commands</u>
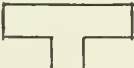
        Forward   FP   Clearscreen   CS
        Back   BK   Draw
        Left   LT   Nodraw
        Right   RT
        Home   <u>Pencolors</u>
        Penup   PU
        Pendown   PD   PC∅   Black
        Hide Turtle   HT   PC1   White
        Show Turtle   ST   PC2   Green
        Pencolor   PC   PC3   Violet
        Background   BG   PC4   Orange
                                            PC5   Blue
        <u>Special Keys</u> - ESC   PC6   Reverse

  3.   Compile a set of commands to draw a specific shape (SQUARE).
        Create this on an overhead transparency and demonstrate on the
        computer using a large monitor.

                    FD 50
                    RT 90
                    FD 50
                    RT 90
                    FD 50
                    RT 90
                    FD 50
                    RT 90

  4.   Workshop participants should then experiment with the turtle
        commands. Set up problems for them to solve.
        For example, have participants create the following:

        a)   c)

        b)   d)

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5.   Demonstrate the use of the repeat function.
      Use the original commands for the square.
          FD 30
          RT 90
          FD 30
          RT 90
          FD 30
          RT 90
          FD 30
          RT 90

      Which commands are repeated?

          FD 30   RT 90

      How many times are they repeated?

          REPEAT 4 [FD 30 RT 90]
                    ↑   ↑
                  Shift N   Shift M

6.   Explain that turtle rotation for a complete circle is 360°.
      Therefore, in order to complete a square, each corner must be
      90° (90° × 4 = 360°). The turtle will then return to its
      original position.
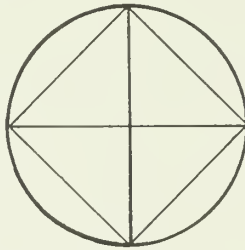
7.   Develop together on an overhead the commands for drawing a
      pentagon.

          REPEAT   5 [FD 50   RT 72]
                                ↓
                         360 ÷ 5 = 72

      Demonstrate this on the computer.

8.   Participants of the inservice should now explore using the
      repeat command. Set up problems for them to solve.

          For example:

          triangle   (3 sides)
          hexagon   (6 sides)
          octagon   (8 sides)
          dodecagon (20 sides)
          circle

9. Demonstrate the use and development of procedures.
    The only way to save any work that might have been done is to
    teach the turtle a new word or command. These are called
    procedures.

    How to set up a procedure:

        (type)   TO SQUARE

        (type in   REPEAT 4 [FD 20 RT 90]
        the commands)   END

        (press)   ⌈CTRL⌉ - C (to define the procedure)

        (type)   SQUARE (turtle draws a square)

    Develop on overhead and demonstrate on a computer.

10. Participants should experiment with the development of
    procedures. Set up problems for them to solve.

    For example, write procedures for the following:

        a) triangle
        b) circle
        c) rectangle
        d) square

    Using these procedures create the following designs on the
    screen.
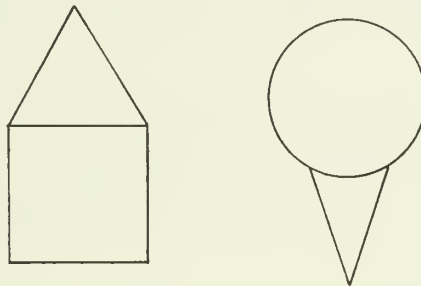
11. Other areas for inservice.

        11.1 Editing a procedure
              Special key functions
              CTRL-P
              CTRL-N
              CTRL-O
              CTRL-A
              CTRL-E
              CTRL-D
              CTRL-K

11.2 Clear, save and recall workspace.

        Commands: POTS
                    PO
                    ERASE <u>ALL or ERASE</u> (Procedure Name)
                    SAVE <u>"   </u>
                    READ <u>"   </u>
                    CATALOG

12. <u>Additional Suggestions</u> for Inservice Activities (if a full day session is planned).

    12.1 Use procedures within procedures.

    12.2 Use variables in procedures.

    12.3 Demonstrate recursion (a recursive procedure defines a procedure in terms of itself).

Suggested Materials For LOGO Workshop (Part Three):

   Overhead transparencies and projector.

   One large monitor with a cable to the computer for large group viewing of demonstrations.

   Computer hardware - 2:1 Teacher to Hardware ratio. If the computers have only 48K RAM, a 16K RAM card must be inserted into each computer.

   LOGO Software.

   Problem-solving activities on a transparency or activity cards.

   Turtle commands printed on worksheets - one sheet per participant.

   Bibliography of references to explore for additional information on LOGO.

The presentation should focus on using LOGO for problem-solving activities.

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Part Four: Programming a Computer in BASIC (Half Day Session).

    4.1 Deferred vs. Immediate Mode.

    4.2 BASIC Statements - line numbers, PRINT, END, tabulation, NEW, clearing screen.

    4.3 Listing and Saving Programs on the Diskette - including suggestions for saving students' programs.

<center>COFFEE BREAK</center>

    4.4 Inserting, Deleting Lines/Programs.

    4.5 Producing Backup Copies of Diskettes/Programs.

    4.6 Demonstrating Printer Operations - setting up the printer for form and sheet feed, troubleshooting, listing and running programs on the printer (optional).

Suggested Materials (Parts One, Two, Four)

Worksheets for participants (e.g. the programming exercises in the Integrated or Discrete Teaching Unit).

Computer Hardware with a printer - 2:1 Teacher to Hardware ratio; a minimum of one printer per group of 20 teachers.

One large monitor with a cable to the computer for large group viewing of demonstrations.

System Master or Utility Diskette.

Multiple copies of diskettes with CAI and other programs (e.g. selections from the MECC programs - see Section III of this curriculum guide - Software).

Overhead transparencies.

Overhead projector.

One uninitialized diskette for each participant.

Introduction to the Apple II in Instruction: Training Materials.
Minnesota Educational Computing Consortium, 1980. Available from ACCESS Media Resource Centre, Calgary.

The presentation should stress demonstration by the workshop leader combined with extensive "hands-on" participation by the teachers.

DAY TWO
(Two or Three Months After Day One Sessions)

Objectives: 1.   The teachers will become more proficient with computer
                   operations and with software applications programs.

              2.   The teachers will discuss problems encountered in
                   implementing the computer literacy unit.

MORNING

Part One: Using a Word Processor in Division II (Half Day Session).

    1.1   Word Processing Applications in Division II.

    1.2   Loading the Word Processor Program - review guidelines for
          using diskettes and disk drive (Section 1.2 of Day One
          Workshop).

    1.3   Accessing the Menu.

    1.4   Loading and Editing an Existing File - edit keys,
          capitalization, insertion, deletion, spacing, margin control
          (Note: Instructor should have sample files on diskettes).

COFFEE BREAK

    1.5   Writing and Saving a New File on a data diskette.

    1.6   Setting Printer and Printing a File.

NOTE: Some word processing packages include a tutorial on the
        diskette.

Part Two: Computer Literacy Techniques, Resources and Problems
(Half Day Session).

NOTE: Topics could be based upon a survey of the workshop
        participants prior to the workshop.

Suggested Activities:

    2.1   Alternatives techniques for introducing computer literacy
          concepts in the classroom.

    2.2   New resources that assist in implementing the computer
          literacy unit.

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2.3   Discussion/demonstration of problems encountered by
         individual teachers.

   2.4   Involving parents, other staff members and administrators
         in the computer literacy project.

Sample Materials:

   Worksheets for participants (e.g. specific programming exercises
   developed upon the basis of the survey).

   Word Processor programs.

   Diskettes containing word processor text files (data diskettes).

   Instruction sheets for using the word processors.

   Computer hardware with printers - 2:1 Teacher to Hardware ratio;
   a minimum of three printers per group of 20 teachers in order to use
   word processing package.

   One large monitor with cable to the computer.

   System Master or Utility Diskette.

   Copies of new resources.

   Overhead transparencies.

   Overhead projector.

The presentation could include large group discussion, demonstration of
the word processor and other new software, "hands-on" participation
using the word processor to produce a short composition, and
utilization of new software resources.

APPENDIX 2

JUNIOR HIGH COMPUTER LITERACY COURSE

Topics:

    Topic 1: What is a computer?

    Topic 2: How to operate a computer

    Topic 3: Computer programming

    Topic 4: Computers uses in society

    Topic 5: How computers affect society

At the junior high level, the computer literacy course comprises 50 hours of instruction and emphasizes the development of a functional or working knowledge of computers. Approximately 60-80% of the time is devoted to Topic 3 with extent of coverage of other topics being dependent upon students' previous computer experiences, including enrollment in the elementary computer literacy unit.

To allow one-third of the total class time for "hands-on" experiences, a minimum of one hardware unit (one computer, one cathode ray tube, one floppy disk drive) per 3 students, with a minimum of one printer per class, is recommended.

The Core components of the junior high course are outlined on the following pages.

CORE COMPONENTS

NOTE: Dimension Codes   -- A = Awareness; F = Function; U = Critical Understanding.
       Status Code   -- R = Review (covered in Junior High course)
       Hands-On Required -- *

Topic 1: What is a computer?

Goals: 1. To develop student understanding of basic computer operations and terminology.
          2. To develop an appreciation of the technological development of computer
              systems.

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
The student will:		
1.0 DESCRIBE THE BASIC OPERATIONS AND HISTORY OF COMPUTER SYSTEMS.		
1.1 Recognize and use basic computer terms.	A	Review terminology from the elementary unit (e.g., names of computer peripherals, system commands, hardware, software, C.P.U., chip, silicon wafer, microprocessor, computer program). Additional terms: algorithm, bug, binary number system, bit, byte, "K", names of secondary or auxiliary storage and primary storage devices, RAM, ROM, arithmetic unit, logic unit, integrated circuit, Very Large Scale Integration, new DOS and BASIC commands from Topics 2 and 3.
1.2 Briefly describe the historical development of computer systems.	AR	Emphasis should be placed upon the rapid changes in computer technology since the 1940's with projections for the future: mechanical, electromechanical, and electronic devices, and the role played by vacuum tubes, transistors, integrated circuits and Very Large Scale Integration (VLSI). Comment: Stress should be placed on the trends rather than the details of technological developments.
1.3 Describe a computer system.	A	There are various types of computers (micro, mini, mainframe). A computer system has certain basic operations including Input-Processing-Output. Each part of a computer system (CPU, arithmetic unit, logic unit, memory, input and output devices, computer program) has a role in these operations. There is a relationship between input and output (e.g. accuracy of data input determines output). Computers may have graphics and sound capabilities. Computers may be connected to each other to access and share information.

Topic 2: How to operate a computer

Goal: To develop student skills, attitudes and interests which facilitate the use of computer systems.

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
The student will: 2.0 USE A COMPUTER SYSTEM.		
2.1 Demonstrate responsible behavior in using a computer system.	F*	There are rules/policies/procedures concerning: - care of hardware: storage, movement, operation - care of software: storage and handling of disks; back-up of programs - ethical use of a computer system: copyright violation; tampering with other users' materials; theft of software storage devices, programs, hardware - scheduling students' access to hardware/software
2.2 Utilize system commands with prepared programs and available hardware.	FR*	Skills to Develop: - using system commands to run prepared programs - using proper procedure to sign-on or off a terminal or power up a micro/mini computer properly - manipulating the flow of information through the use of peripherals (eg. cassette recorder, disk drive, printer) - understanding error messages - locating and using alphanumeric and special function keys on a computer keyboard - reading and comprehending documentation written at the students' level (eg. teacher guide sheets, some computer manuals)

Topic 3:   Computer programming

Goal: To have students appreciate that effective problem-solving with computer systems
           requires the application of logical thought processes and develop the skills
           required for a holistic, systematic approach to problem-solving.

	OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
	The student will:		
3.0	FOLLOW AN ORDERLY SEQUENCE OF STEPS IN DEVELOPING A PROGRAM TO SOLVE A PARTICULAR PROBLEM.		Comment: Approximately 60-80% of course time requirements should be spent on this topic.
3.1	Recognize that BASIC is one of the languages commonly used on micros.	A	A computer will not function properly unless instructions are stated in the language of the particular computer.
3.2	Outline a procedure (algorithm) to solve a problem.	F	Skills to develop: - properly defining problems - recognizing flow chart symbols - reading and explaining a flow chart - drawing a flowchart to represent a solution to a problem
3.3	Code a given procedure (algorithm) into a computer program.	F*	Skills to develop: - providing an operational definition of computer program' - recognizing the difference between system commands and program statements - using NEW, SAVE, LIST, DELETE, LOCK, UNLOCK commands or their equivalent in another computer language - producing programs that include the following components of BASIC or their equivalent in another computer language: meaningful variable names; numeric and string variables; END, STOP, LET, PRINT, INPUT, tabulation statements; mathematical operators, application of rules determining order of evaluation of mathematical operators; relation symbols $(< > =)$ conditional (IF/THEN) and unconditional (GOTO) branching; simple graphics; readable output through appropriate formatting; brief documentation (eg. REM statements)
3.4	Be able to analyze computer programs.	F*	Skills to develop: - testing and debugging personal programs and checking results for correctness - understanding programming error messages - analyzing simple programs, detecting logic and syntax errors, and determining the value of each variable to be output
3.5	Display confidence in his/her ability to use and control computers.	F*	Comment: All students should be provided with the opportunity to independently design and successfully demonstrate their computer programs.

Topic 4: Computer uses in society.

Goal: 1. To have students appraise the applications, limitations and capabilities of computer systems.

2. To promote a greater understanding and increase utilization of computer technology in other subject areas.

	OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
	The student will:		Comment: This section should provide a brief overview of the concepts indicated.
4.0	DESCRIBE THE BASIC APPLICA-TIONS, LIMITA-TIONS, AND CAPABILITIES OF COMPUTERS.		
4.1	Identify specific tasks performed by computers in various areas of society.	AR	Examples of areas where computers are used: banking, manufacturing, transportation, government, recreation, publishing, creative arts, medicine, business, research, military, law enforcement, libraries, weather prediction, education, the home.
4.2	Describe computer capabilities and limitations.	A	Computers are best suited for tasks requiring speed, accuracy, repeated operations and processing of large amounts of data.
4.3	Identify tasks which are not suited to computer applications.	F*	Some problems require computer use while others do not: - use a computer and a calculator to perform similar mathematical tasks, including non-repetitive calculation, and compare efficiency of the two devices; - use a computer for a decision involving a value judgement or a personal opinion.
4.4	Describe why a computer can only do what people instruct it to do.	U	A computer needs a program to operate. Instructions must be exact. "Computer errors" are usually errors made by people. A computer is only an electronic device and cannot make independent decisions.

Topic 5: How computers affect society.

Goal: To have students assess the current and potential impact of computer systems on society.

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
The student will: 5.0 APPRECIATE THE IMPACT THAT COMPUTERS CAN HAVE ON OUR LIFESTYLE.		Comment: This section should provide a brief overview of the concepts indicated.
5.1 Describe ways in which computers can directly and indirectly affect his/her life.	U	The increasing use of computers in society has both advantages and disadvantages. For example, computers have an impact on: - employment and career opportunities - the education system - the economic structure - crime and crime detection - access to information - copyright laws

APPENDIX 3

COMPUTER LITERACY PERIODICALS

APPENDIX 3.0 Student Periodicals

Bits'n Bytes Gazette
     Computer Science Press, Inc.
     11 Taft Court
     Rockville, Maryland 20850

     Cost: $12.00 per volume. Reduced prices available for
            purchase of class sets.

     Volume One of this gazette contains ten eight-page computer
     literacy newspapers for students in grade 4, 5 and 6. The
     newspapers have a variety of visuals, short articles, and skill/
     drill activities on computer history, applications, careers, and
     programming.

Compukids
     P.O. Box 874
     Sedalia, Missouri 65301

     Cost: $20/year

     Designed for elementary and junior high school students, this
     periodical provides a wide variety of articles, tutorials,
     interviews, stories, puzzles, and games for students who are just
     starting to use computers.

Turtle News and LOGO Newsletter
     Young Peoples' LOGO Association
     1208 Hillsdale Drive
     Richardson, Texas 75081

     Cost: $30/year

     Although it focuses on LOGO, PILOT and Turtle Graphics
     programming, this newsletter also features articles and programs
     in BASIC. Designed for children aged seven and up.

NOTE: Articles on computers also appear in general interest, news, and
       science periodicals (e.g. Time, Discover, Popular Science,
       National Geographic magazine).

APPENDIX 3.1

Recommended Professional Periodicals

Compute

    Post Office Box 5406
    Greensboro, North Carolina 27403

    Frequency: 12 issues/year   Cost: $25.00/year

A monthly compendium of articles on the impact of microcomputers, applications for the handicapped, programs, and reviews of hardware, software and print materials. Teachers and students at an intermediate or advanced level of computer literacy can use the complete BASIC and machine language listings of games, utilities, and applications programs for home and/or educational situations.

Computers in the Classroom

    Broadview Publishing
    3 Carlaw Avenue
    Toronto, Ontario
    M4M 2R6

    Frequency: 10 issues/year   Cost: $15.00/year

A Canadian periodical containing explanations of how specific pieces of hardware operate, checklists for troubleshooting, courseware ideas, computer programming explanations and tutorials for teachers at beginner, intermediate and advanced levels of computer literacy.

The Computing Teacher

    Department of Computer & Information Science
    University of Oregon
    Eugene, Oregon 97403

    Frequency: 9 issues/year   Cost: $20.00/year

Edited by one of the leading CAI educators, David Moursund, this journal focuses on teacher education, computer-assisted instruction, and the impact of computers on the curriculum. It contains updates on news in the field of educational computing, research articles, book and software reviews, special departments on computers in the Science and English curricula, and a variety of feature articles to assist teachers and administrators in computer-related activities.

Creative Computing

        P.O. Box 789-M
        Morristown, New Jersey 07960

        Frequency: 12 issues/year   Cost: $30.00/year (?)

One of the most general and useful microcomputer periodicals, this
journal has articles, reviews, program listings and monthly columns as
well as cartoons, short stories, puzzles and feature articles on a
variety of microcomputer topics.

Electronic Learning

        Scholastic-TAB Publications Ltd.
        Richmond Hill, Ontario
        L4C 3G5

        Frequency: Bi-monthly   Cost: $22.00/year (?)

This educational computing periodical contains feature articles on
hardware selection and advances, computer applications in educational
settings, columns on inservice and administrative considerations, book
and software reviews, and information on new products.

RECOMMENDED FOR FIRST PURCHASE: The Computing Teacher and Creative
Computing.

APPENDIX 3.2

Supplementary Professional Periodicals

Alberta Printout
      ASCE, Box 638
      SUB Post Office II
      The University of Alberta
      Edmonton, Alberta
      T6G 2E0

      Cost: Provided quarterly to members of Alberta Society for
             Computers in Education.

      Membership Fee: $20.00/year

Apple Education News
      Box 20485
      San Jose, California 95160

      Cost: Free

ATACC Newsletter
      Alberta Teachers' Association Computer Council
      Barnett House, 11010 142 Street
      Edmonton, Alberta

      Cost: Provided quarterly to members of the Alberta Teachers'
             Association Computer Council.

      Membership Fee: $25.00/year

Byte: The Small Systems Journal
      Box 590
      Martinsville, New Jersey Q8836

      Cost: $21.00/year

      Note: Articles are highly technical.

Canadian Datasystems
      Box 444, Station A
      Toronto, Ontario
      M5W 1C2

      Cost: $15.00/year

Calculators Computers Magazine
     c/o Dymax P.O. Box 310
     Menlo Park, California 94025

     Cost: ?

Classroom Computer News
     Box 266
     Cambridge, Mass. 02138

     Cost: $12.00/year

Course Ware Magazine
     4919 N. Millbrook #222
     Fresno, California 93726

     Cost: $50.00/year

     Note: 5 issues each with machine-readable programs on a cassette
     for Apple, PET, or TRS-80 computers. Specify your computer model.

ECCO Newsletter
     Box 1015
     Station B, Ontario
     M5T 2T9

     Cost: $10.00/year (membership fee)

     Note: This is the quarterly newsletter of the Educational
     Computing Organization of Ontario.

Infoage
     211 Consumers Road Suite 302
     Willowdale, Ontario
     M2J 9Z9

     Cost: $15.00/year

Infoworld: The Newsweekly for Microcomputer Users
     Circulation Department
     375 Cochituate Road
     Box 837
     Framingham, Mass. 01701

     Cost: $65.00/year (weekly)

Journal of Computers in Mathematics and Science Teaching
     P.O. Box 4455
     Austin, Texas 78765

     Cost: $10.00/year (quarterly)

Kilobaud Microcomputing
      80 Pine Street
      Peterborough, New Jersey 03458

      Cost: $30.00/year

Learning with Computers: A National Publication for Canadian Educators
      P.O. Box 185
      West Hill, Ontario
      M1E 4R4

      Cost: $18.00/year

Nibble: The Reference for Apple Computing
      Box 325
      Lincoln, Mass. 01773

      Cost: $25.00/year (?)

Personal Computers
      1 Fawcett Place
      Greenwich, Conn. 06830

      Cost: $2.00/issue

      Note: This is Mechanix Illustrated's quarterly magazine on
      microcomputers.

Personal Computing
      Circulation Department
      1050 Commonwealth Avenue
      Boston, Mass. 02215

      Cost: $28.00/year (?)

Popular Computing
      70 Main Street
      Peterborough, New Hampshire 03458

      Cost: $22.00/year

Recreational Computing
      P.O. Box E
      Menlo Park, California 94025

      Cost: $25.00/year (?)

DIRECTORY OF PUBLISHERS/DISTRIBUTORS

ACCESS Media Resource Centre
295 Midpark Way S.E.
Calgary, Alberta
T2X 2A8

Addison-Wesley Publishing Company Ltd.
26 Prince Andrew Place
P.O. Box 580
Don Mills, Ontario
M3C 2T8

Alberta Book and Novelty (1982) Ltd.
7140 Fairmount Drive S.E.
Calgary, Alberta
T2H 0X4

Avon Books of Canada
2061 McGowan Rd.
Suite 210
Scarborough, Ontario
M1S 3Y6

Broderbund Software
1938 Fourth Street
San Rafael, California
U.S.A. 94901.

Camelot Publishing Company
P.O. Box 1357
Ormond Beach, Florida
U.S.A. 32074

Creative Computing Press
P.O. Box 787M
Morris Plains, New Jersey
U.S.A. 07950

Creative Programming Inc.
604 Sixth St.
Charleston, Illinois
U.S.A. 61920

Fitzhenry & Whiteside Ltd.
150 Lesmill Rd.
Don Mills, Ontario
M3B 2T5

General Publishing Co. Limited
30 Lesmill Rd.
Don Mills, Ontario
M3B 2T6

Guidance Centre, Faculty of Education
University of Toronto
252 Bloor St. West
Toronto, Ontario
M5S 2Y3

Hastings House Publishing Inc.
10 East 40th Street
New York, New York
U.S.A.   10016

Hayes Publishing Ltd.
3312 Mainway
Burlington, Ontario
L7M 1A7

Hollinger House Ltd.
25 Hollinger Rd.
Toronto, Ontario
M5B 3G2

Holt, Rinehart and Winston of Canada Ltd.
55 Horner Ave.
Toronto, Ontario
M8Z 4X6

International Council for Computers in Education
Dept. of Computer and Information Science
University of Oregon
Eugene, Oregon
U.S.A. 97403

Krell Software Corporation
1320 Stony Brook Rd.
Stony Brook, New York
U.S.A. 11790

Lawrence Hall of Science
University of California
Berkeley, California
U.S.A. 94720

The Learning Tree
Richard Jones
c/o Jonust Farms
RR1
Ponoka, Alberta
T0C 2H0

McGraw-Hill Ryerson Limited
330 Progress Ave.
Scarborough, Ontario
M1P 2Z5

McIntyre Educational Media Lt.
30 Kelfield St.
Rexdale, Ontario
M9W 5A2

Methuen Publications
161 Eglinton Ave. East
Suite 102
Toronto, Ontario
M4P 1J5

Minnesota Curriculum Services C
3554 White Bear Ave.
White Bear Lake, Minnesota
U.S.A. 55110

MIT Press
28 Carleton Street
Cambridge, Mass.
U.S.A. 02142

Random House of Canada
5390 Ambler Drive
Mississauga, Ontario
L4W 1Y7

T.S. Denison and Company, Inc.
9601 Newton Avenue South
Minneapolis, Minnesota
U.S.A 55431

Trinity Ventures Corporation
B5-4255 Arbutus Street
Vancouver, B.C.
V6J 4R1

Van Nostrand Reinhold Publishers
1410 Birchmount Rd.
Scarborough, Ontario
M1P 2E7

Young People's LOGO Association
1208 Hillsdale Drive
Richardson, Texas
U.S.A. 75081